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[Name of Document] SPECIFICATION

[Title of the Invention] LIQUID CRYSTAL DISPLAY AND ELECTRONIC APPARATUS

[Claims]

[Claim 1] A liquid crystal display, comprising:

a liquid crystal display panel formed of liquid crystals sandwiched between a pair of substrates facing each other, and including pixels comprising a plurality of sub-pixels each corresponding to different colors;

an illumination device provided to the opposite side of the liquid crystal display panel in relation to the observation side for illuminating the liquid crystal display panel with illumination light;

a transreflective layer disposed on the opposite side of the liquid crystals in relation to the observation side with a transmissive portion for transmitting the illumination light formed thereto, wherein the transmissive portion is formed such that the dimension of a transmissive area corresponding to the transmissive portion at least at one sub-pixel out of the plurality of sub pixels and the dimension of a transmissive area corresponding to the transmissive portion at another sub-pixel, differ; and

a color filter provided corresponding to each of the sub-pixels, for transmitting light of a wavelength corresponding to a color of each sub-pixel.

[Claim 2] A liquid crystal display according to Claim 1, wherein the dimension of the transmissive area at each sub-pixel is a dimension according to the spectral properties of the illumination light.

[Claim 3] A liquid crystal display according to Claim 2, wherein the dimension of the transmissive area at each sub-pixel is a dimension according to the luminance of a wavelength of the illumination light corresponding to a color of the sub-pixel.

[Claim 4] A liquid crystal display according to Claim 3, wherein the dimension of the transmissive area at a sub-pixel of a color corresponding to a wavelength of the illumination light with great luminance is smaller than the dimension of the transmissive area at a sub-pixel of a color corresponding

to a wavelength of the illumination light with small luminance.

[Claim 5] A liquid crystal display according to any one of Claim 1 through Claim 4, wherein the dimension of the transmissive area at each of the sub-pixels differs for each sub-pixel corresponding to a different color.

[Claim 6] A liquid crystal display according to any one of Claim 1 through Claim 4, wherein the dimension of the transmissive area at each of the sub-pixels differs according to the position of the sub-pixel within the substrate face of the liquid crystal display panel.

[Claim 7] A liquid crystal display according to any one of Claim 1 through Claim 6, wherein the transmissive portion is an opening portion formed in the transreflective layer corresponding to each of the sub-pixels.

[Claim 8] A liquid crystal display according to Claim 7, wherein the opening portion comprises opening parts of generally the same dimension that are formed mutually separated for the number according to the dimension of the transmissive area at the sub-pixels.

[Claim 9] A liquid crystal display according to any one of Claim 1 through Claim 6, wherein the transreflective layer has the transmissive portion formed such that an area along at least one side of a plurality of sides defining each sub pixel serves as the transmissive area.

[Claim 10] A liquid crystal display, serving as a transreflective liquid crystal display which performs displaying by switching between a transmissive mode and a reflective mode, comprising:

    a liquid crystal layer sandwiched between an upper substrate and a lower substrate facing one another;

    a transreflective layer which has a transmissive area for transmitting light and a reflective area for reflecting incident light from the upper substrate side, and which is disposed on the inner side of the lower substrate;

    a color filter disposed on the upper side of the transreflective layer, upon which a plurality of pigment layers with different colors according to each of sub-pixels forming a display area are arrayed;

and

an illumination device disposed on the outer side of the lower substrate,

wherein the pigment layers are formed over the entirety of an area overlapping the transmissive area in a planar manner and an area overlapping the reflective area in a planar manner, and at least one color pigment layer is formed only at a part of an area overlapping the reflective area in a planar manner,

and wherein the dimension of a pigment layer formation area, where the pigment layers are formed, is formed so as to be different between at least one color pigment layer out of the plurality of pigment layers of differing colors and another color pigment layer.

[Claim 11] A liquid crystal display according to Claim 10, wherein the pigment layers comprise a red layer, a green layer, and a blue layer, and wherein the dimension of the pigment layer formation area is formed so as to be smaller for the green layer than for the red layer and blue layer.

[Claim 12] A liquid crystal display according to either Claim 10 or Claim 11, further comprising a transparent film for smoothing the step between the pigment layer formation area and the area where the pigment layers are not provided.

[Claim 13] A liquid crystal display according to any one of Claim 10 through Claim 12, wherein the transmissive area is formed by the transreflective layer being opened in a window-like manner.

[Claim 14] A liquid crystal display according to any one of Claim 10 through Claim 12, wherein band-shaped transparent electrodes are disposed on the inner side of the lower substrate, and wherein the transmissive area of a band shape is formed in the transreflective layer by having the transparent electrode pattern width be formed wider than the transreflective layer pattern width.

[Claim 15] A liquid crystal display according to any one of Claim 10 through Claim 14, wherein the transreflective layer is formed of aluminum or an aluminum alloy, and the pigment layer contains the blue layer, and wherein the dimension of the pigment layer formation area is provided so as to be smaller for the blue layer than for the red layer.

[Claim 16] A liquid crystal display according to any one of Claim 10 through Claim 14, wherein the transflective layer is formed of silver or a silver alloy, and the pigment layer contains the red layer and the blue layer, and wherein the dimension of the pigment layer formation area is provided so as to be smaller for the red layer than for the blue layer.

[Claim 17] A liquid crystal display according to any one of Claim 10 through Claim 16, wherein the color properties of the color filter are adjusted by changing the dimension of the pigment layer formation area.

[Claim 18] A liquid crystal display, serving as a transflective liquid crystal display which performs displaying by switching between a transmissive mode and a reflective mode, comprising:

    a liquid crystal display panel formed of a liquid crystal layer sandwiched between a upper substrate and lower substrate facing each other, and including pixels that comprise a plurality of sub-pixels each corresponding to different colors and form a display area; and

    an illumination device provided to the opposite side of the liquid crystal display panel in relation to the observation side for illuminating the liquid crystal display panel with illumination light;

    a transflective layer disposed on the opposite side of the liquid crystal layer in relation to the observation side; and

    a color filter provided above the transflective layer with a plurality of pigment layers of different colors corresponding to each of the sub-pixels arrayed thereupon, for transmitting light of a wavelength corresponding to a color of the sub-pixel,

    wherein a transmissive portion for transmitting the illumination light is formed on the transflective layer that comprises a transmissive area for transmitting light and a reflective area for reflecting incident light from the upper substrate side,

    and wherein the transmissive portion is formed such that the dimension of the transmissive area corresponding to the transmissive portion at least at one sub-pixel of the plurality of sub-pixels and the dimension of the transmissive area corresponding to the transmissive portion at another sub-pixel,

differ,

and wherein the pigment layers of each color are formed over the entirety of an area overlapping the transmissive area in a planar manner and an area overlapping the reflective area in a planar manner, and at least one color pigment layer is formed only at a part of an area overlapping the reflective area in a planar manner,

and wherein the dimension of a pigment layer non-formation area where the pigment layer is not formed at least at one sub-pixel of the plurality of sub-pixels and the dimension of a pigment layer non-formation area at another sub-pixel, differ.

[Claim 19] Electronic apparatus, comprising the liquid crystal display according to any one of Claim 1 through Claim 18.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a liquid crystal display and to electronic apparatus, and particularly relates to a transreflective liquid crystal display capable of display with good coloring and high visibility in both reflective mode and transmissive mode, and also relates to an electronic apparatus using the same.

[0002]

[Description of the Related Art]

Reflective liquid crystal displays are advantageous in that electric power consumption is low, since they do not have light sources such as back-lights, and have conventionally been widely used as accessory display units or the like for various types of mobile electronic apparatus and so forth. However, reflective liquid crystal displays use external light, such as natural light like sunlight, or illumination light, to perform display, and accordingly there has been the disadvantage that the display is not readily visually recognized in dark situations.